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CONTRIBUTIONS TO OUR KNOWLEDGE OF AMERICAN CARBONIFEROUS FLORAS

VIII. ANOTHER MEDULLOSA FROM IOWA

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In the last number of this "Carboniferous Flora" series (Andrews, '45) it was mentioned that xylary fragments of a rather large Medullosan stem were present in a collection of coal balls received from Mr. Frederick O. Thompson, of Des Moines, Iowa; and that while they apparently represented a distinct species they were not sufficiently complete to warrant description. A few weeks after this was published Mr. Thompson sent us another collection of coal balls which included an interesting Medullosa, and this specimen consists of a stelar system that appears worthy of its own alcove in the archives of pteridosperm stem remains.

Perhaps the most disturbing feature connected with coal ball studies is the necessity of casting a decision occasionally as to when to stop and record newly acquired information. One must necessarily draw a line somewhere between the extremes of describing each fragment as it turns up or of waiting indefinitely for a more or less complete set of fossils to accumulate. Unfortunately, the latter may never happen. A statement of Dr. Cannon's in his recent book (Cannon, '45), that "Since no research can be final, every publication is a progress report," seems most appropriate to coal-ball investigations.

The Iowa coal-ball plants previously described (Andrews, '45) were obtained from the Urbandale mine, the location of which is noted on the accompanying map (text-fig. 1). The present specimen, however, was collected from the Shuler coal mine a few miles to the west of the Urbandale mine. The exact location of the Shuler shaft is: 8 miles west of 63rd Street (Des Moines) and 1.2 miles north of U. S. Highway No. 6. The coal vein lies 610 feet above sea level, and 387 feet beneath the surface of the ground which has an elevation of 997 feet.

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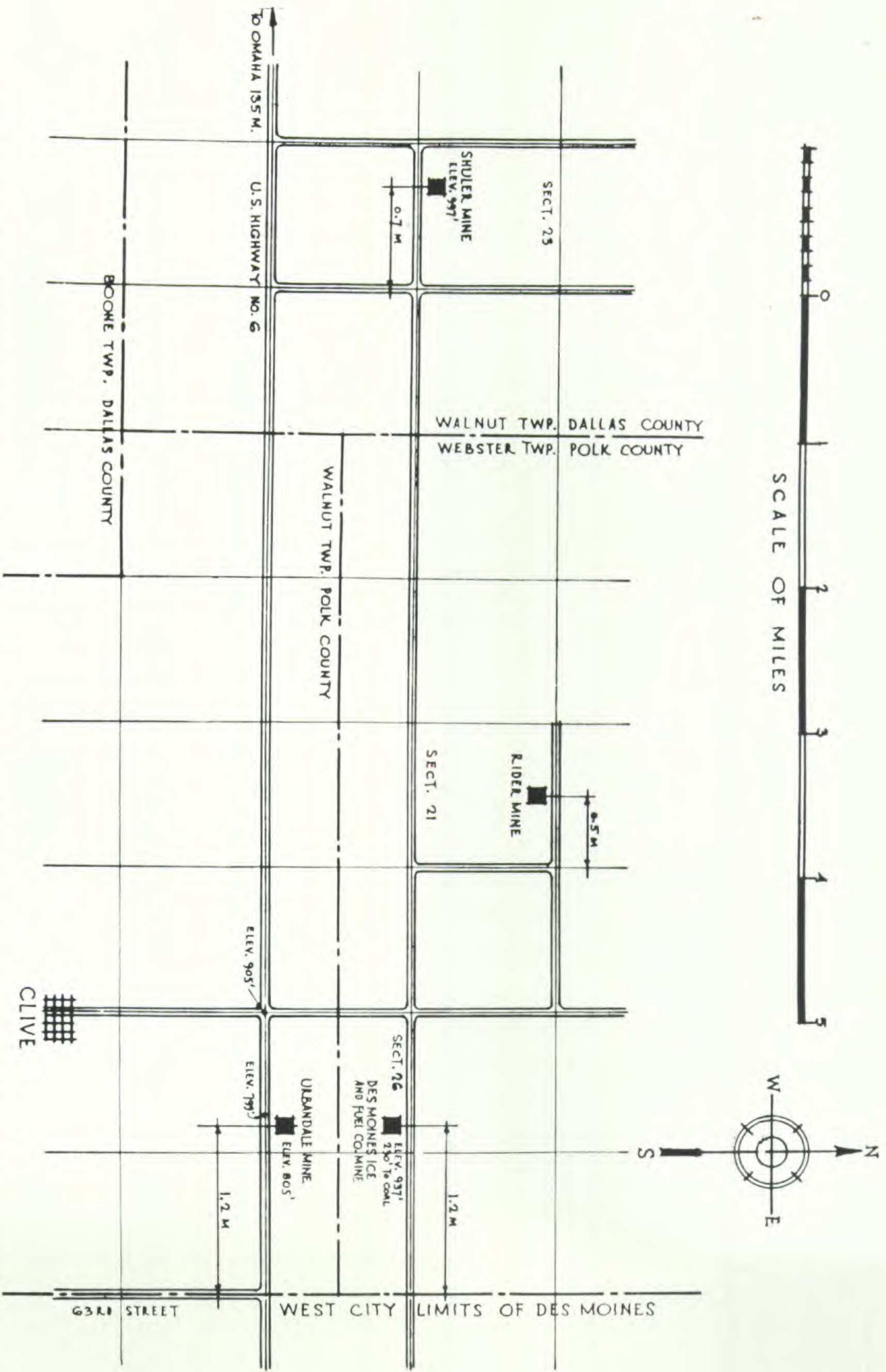
Some question has prevailed as to whether the veins worked by the Shuler and Urbandale mines are continuous. Recently we have been informed by Mr. Charles Bendixen, an official of the Shuler Mine, that drill holes show that the Shuler coal disappears entirely to the east toward the Urbandale mine. There is also some evidence to indicate that the Des Moines Ice and Fuel Co. coal does not extend to that worked by the Shuler mine. However, in view of the general similarity of the fossil floras from the two mines (Shuler and Urbandale), the fact that the shafts are but six and one-half miles apart and that there is a difference of only ten feet in the elevation of the veins at the position of the respective shafts, it seems likely that they represent contemporaneous Pennsylvanian forests. A more precise statement must await the publication of recent stratigraphic studies.

Inasmuch as we may reasonably expect more paleobotanical contributions from this region the accompanying map is presented to show the exact geographical position of the productive mines.

Medullosa anglica var. *ioensis*, var. nov.

The single specimen available consists of a stelar system composed of three steles (pl. 1, fig. 1). Although slightly crushed, they were all of approximately the same size in life. The best-preserved one (fig. 2) measures 18 x 10 mm. in transverse section. These measurements are limited by the secondary xylem, the tissues external to which (except for the partly preserved secondary phloem) being absent. The primary xylary body of this stele is somewhat crushed and distorted but apparently measured about 2 mm. in diameter in life. The radial development of the secondary xylem in two of the steles is fairly uniform, while the third (fig. 1c) displays pronounced endocentricity. The rather weak development and loose organization of the xylem on one side of stele *a* (fig. 1) is apparently the result of stelar branching.

Although the endocentric stele is crushed, the primary xylary body is, for the most part, intact (fig. 3). The relative amount of parenchyma associated with the primary tracheids is markedly greater than that in either *M. anglica* or *M. Thompsonii*. In the latter the primary body consists almost entirely of tracheids, while in *M. anglica* there is a somewhat greater admixture of parenchyma. According to Scott's account of the English species: "The whole interior of each stele . . . is occupied by the primary wood, which consists of elements of two kinds—tracheides and parenchymatous cells. The arrangement and relative proportions of the two constituents vary much in different steles, and in different parts of the same. At some places, the tracheides form a continuous system over a considerable area, only interrupted by scattered strands of parenchyma In other cases the tracheides are arranged in definite groups, separated from one another by a network of parenchyma, while sometimes the cellular tissue predominates, and is traversed by comparatively few tracheides, isolated, or in small groups In no case is there any differentiation of a true 'partial pith,' or even any marked increase in the amount of parenchyma towards the middle of the stele." [Scott, '99, p. 88].



Text-fig. 1. Map showing coal mines near Des Moines, Iowa, where coal balls have been found. By Frederick O. Thompson.

It is evident from Scott's description that the primary xylem in the steles of *M. anglica* presents appreciable variation with respect to the tracheid-parenchyma ratio. In view of the size variation in the steles this might be expected according to Bower's ('30) size and form principles. However, in the three major steles composing the stem of *M. anglica*, the primary bodies appear (Scott, '99, pl. 6, photo 5) to be of about the same areal size and the tracheid-parenchyma ratio seems to be uniform in all. Comparing that figure with a corresponding one of *M. anglica* var. *ioensis*, two features are noticeable: first, the primary body in the steles of the Iowa specimen is much crushed which in itself would suggest relatively more of the delicate thin-walled conjunctive parenchyma, and second, where the primary wood is well preserved (fig. 3) the relative paucity of tracheids is conspicuous. The crushed nature of the primary tissues of *M. anglica* var. *ioensis* makes it impossible to make an accurate size comparison with *M. anglica*.

The radial walls of the secondary tracheids are composed of closely compacted and, for the most part, irregularly arranged bordered pits (fig. 5), an organization so characteristic of many supposed pteridosperms. Individually the pits vary from oval to an irregularly angular outline where they are most closely compacted. Occasionally they are nearly hexagonal, tending to be arranged in vertical rows. In a few cells the pit orifices are remarkably well preserved, being slender, horizontally orientated slits (fig. 4).

The wood rays, which may be classified in group IIB (Andrews, '40), are very narrow, being one to three cells wide, and of great height, exceeding 6. mm.

Associated with the steles, although not organically connected, are two small segments of the outer cortical rind of a Medullosan stem or petiole. While the epidermis of these fragments is missing, the general organization of the fibrous strands and of the enclosing parenchyma resembles that of *M. anglica*. In one of the two fragments secretory canals are especially abundant, abutting on nearly every fibrous strand, and present an appearance not unlike that of *Myeloxylon Bendixenii* (Andrews, '45, pl. 7).

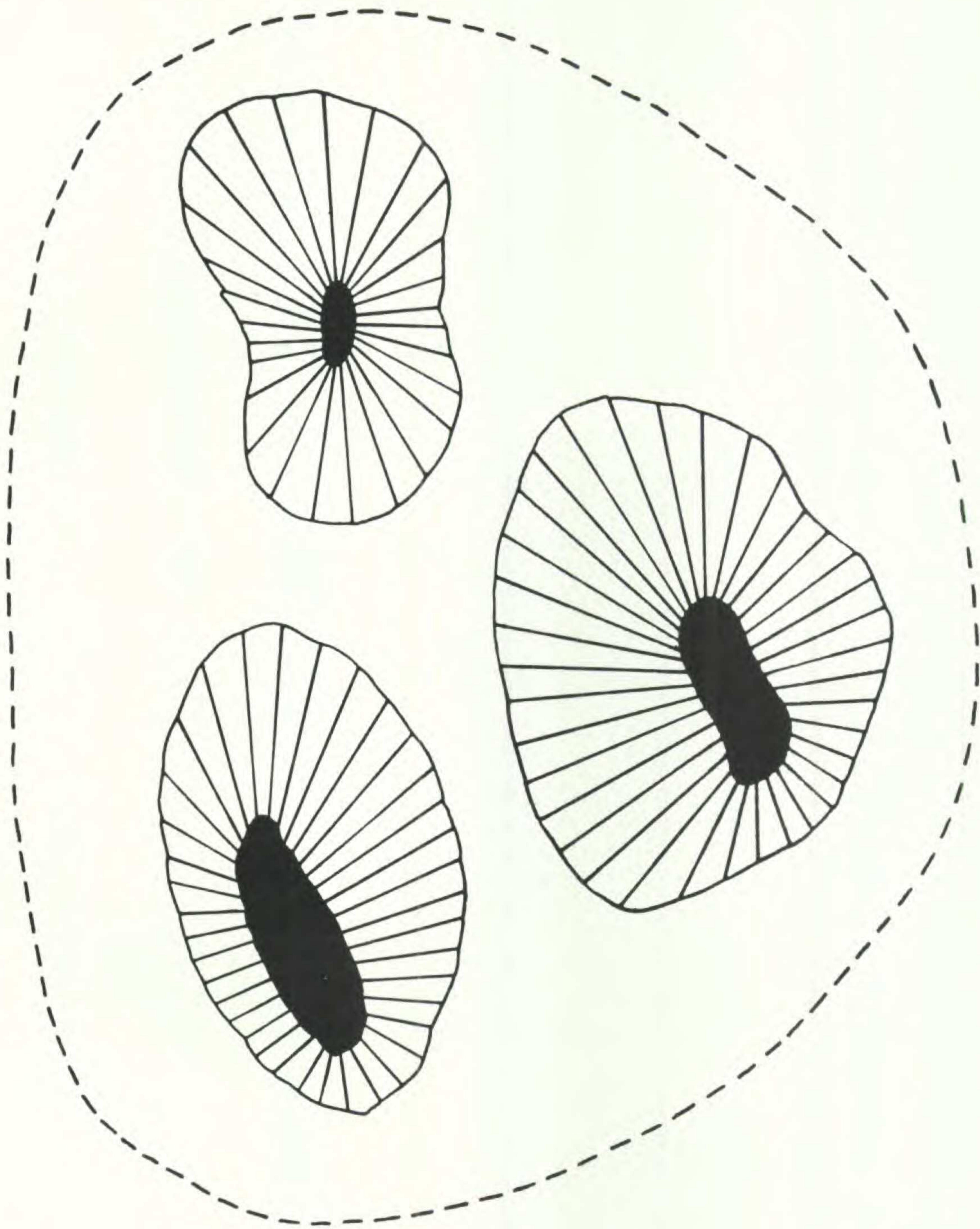
Locality: Shuler Coal Mine, Des Moines, Iowa.

Horizon: Des Moines Series, Pennsylvanian.

Type specimen: No. WCB425, Henry Shaw School of Botany, paleobotanical collections.

Discussion.—

There are now some eight species and varieties assigned to the Anglorota section of *Medullosa*. Whether or not these will all retain their present taxonomic distinction in the light of a future monographic study is a decision that we are not obliged to meet at the moment. There already exists a most interesting series of stems displaying significant, although more or less intergrading, anatomical variations. Some of these are perhaps only physiological variations while others appear to carry more taxonomic weight. Until more information has accumulated con-



Text-fig. 2. A diagram showing the (somewhat restored) stelar system of *Medullosa anglica* var. *ioense*. The primary xylem is indicated in solid black, the secondary xylem by radiating lines, and the probable position of the stelar periderm by the dotted line. This diagram has been prepared at a magnification of x 2.8 to facilitate comparison with other members of the *Anglorota* group shown in pl. 12 of Part VII of this series (Andrews, '45).

cerning this most important Pennsylvanian genus it seems most expedient to take advantage of even relatively slight structural differences.

In the account of *Medullosa Thompsonii* considerable weight was placed on the anatomy of the cortical tissues, particularly the fibrous strand-secretory canal relationship. However, since this tissue is lacking in the present specimen we are

handicapped in making a precise comparison. If the two associated cortical fragments belong with the stelar system they present characters, correlating with those of the primary wood, that clearly separate them from *Medullosa Thompsonii*. In both of these characters the new stem lies closest to the English *M. anglica*.

The qualitative differences separating the species of this group as a whole are by no means striking yet there are good reasons for believing that, such as they are, they may be of sound taxonomic validity. First, it is well known that stem anatomy in general is of a more conservative nature than that of other plant organs such as foliage or reproductive structures. Second, the Iowa coal balls contain a considerable variety of seeds, a number of which are, in all probability, those of pteridosperms.

It is a trifle embarrassing that the present report had to be given separately so soon after the previous account of Iowa *Medullosas*. On the other hand, we are not averse to hoping that future discoveries will render possible a continuation of these reports regardless of how long or short the intervals may be.

Acknowledgment.—

Thanks are again due to Mr. Frederick O. Thompson for his vital and continued interest in furthering these investigations.

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EXPLANATION OF PLATE

PLATE 1

Medullosa anglica var. *ioense*

- Fig. 1. The stelar system in transverse section. Slide 1391, x 2.8.
 Fig. 2. Stele *a* shown at a higher magnification. Slide 1391, x 5.0.
 Fig. 3. A portion of the endocentric stele *c* showing the primary xylem and part of the secondary tissues. Slide 1391, x 5.8.
 Fig. 4. Radial view of part of a secondary tracheid showing the slit-like, nearly horizontal orifice of the pits. Slide 1392, x 125.
 Fig. 5. Radial view of part of three secondary tracheids showing the arrangement of the pits. Slide 1392, x 66.